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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,029	09/25/2003	Thomas S. Dory	42P16663	7708
8791	7590	09/01/2006		
BLAKELY SOKOLOFF TAYLOR & ZAFMAN 12400 WILSHIRE BOULEVARD SEVENTH FLOOR LOS ANGELES, CA 90025-1030				
			EXAMINER VAN, LUAN V	
			ART UNIT 1753	PAPER NUMBER

DATE MAILED: 09/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/672,029	<b>Applicant(s)</b> DORY ET AL.	
	<b>Examiner</b> Luan V. Van	<b>Art Unit</b> 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 01 August 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>4/27/06</u> | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 1, 2006 has been entered.

### ***Response to Amendment***

Applicant's amendment of August 1, 2006 does not render the application allowable.

### ***Status of Objections and Rejections***

All rejections from the previous office action are maintained.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-15 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Palmans et al.

Regarding claims 1 and 9, Palmans et al. teach a method of forming a microelectronic structure forming a recess in a substrate (figure 7-8); forming a metal layer (i.e., Ti/TiN layer by physical vapor deposition or atomic layer CVD, column 7 lines 53-56) within the recess; activating (column 6 lines 58-67) the barrier layer within the recess; electrolessly depositing a seed layer (column 7 lines 8-24) within the recess; and forming a metal fill layer over the seed layer (column 8 lines 12-46).

Since the metal layer Ti barrier layer of Palmans et al. is deposited by the same method (i.e., physical vapor deposition or atomic layer deposition, see column 7 lines 53-56) as that of the instant invention and to a thickness range of 15 nm, or 150

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Angstrom, (column 8 lines 20-24), in features having the aspect ratios of 2:1 or higher (column 9 lines 5-10), it would have been obvious to one having ordinary skill in the art to expect that the Ti layer of Palmans et al. is non-continuous. Furthermore, since the palladium activator solution and subsequent electroless plating solution is applied on the surface of the metal layer, it would have been obvious to one having ordinary skill in the art to expect that the activator solution and electroless plating solution is activating or depositing on the metal layer and on at least the non-deposited region within the recess.

Regarding claim 2 and 10, Palmans et al. teach forming a high aspect recess comprising an aspect ratio up to 3.5 (column 8 lines 37-46), which is within the range of the instant claim.

Regarding claim 3 and 11, Palmans et al. teach forming a non-continuous comprising of Ti/TiN (column 6 lines 49-51).

Regarding claim 12, Palmans et al. teach electrolessly depositing a copper layer comprising a grain size of about 1  $\mu\text{m}$  or greater, since the copper layer of Palmans et al. is deposited by the same method and conditions as those of the instant claim.

Regarding claim 4-5, Palmans et al. teach depositing an activation layer wherein the activating layer within the recess comprises of palladium (column 6 lines 58-67) is formed on the non-continuous metal layer and the at least one non-deposited region within the recess.

Regarding claims 6, 13 and 15, Palmans et al. teach electroplating a copper layer on the seed layer (column 8 lines 35-46).

Regarding claim 7, Palmans et al. teach utilizing a chemical mechanical polishing process (column 8 lines 27-31).

Regarding claim 8 and 14, Palmans et al. teach forming a substantially void free metal fill layer, since Palmans et al. use the same plating method as that of the instant claims.

Claim 1-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shelnut et al. (EP 1201786) in view of Palmans et al.

Regarding claims 1 and 9, Shelnut et al. teach a method of forming a microelectronic structure forming a recess in a substrate (paragraph 32); forming a non-continuous metal layer (i.e., TiN layer by physical vapor deposition, example 1) within the recess; electrolessly depositing a seed layer (paragraph 25) on the non-continuous metal layer and on the at least one non-deposited region within the recess; and forming a metal fill layer over the seed layer (paragraph 26). Since the metal layer or TiN barrier layer of Shelnut et al. is deposited by the same method and conditions in features having the same aspect ratios as those of the instant claims, the TiN layer of Shelnut et al. would be non-continuous.

The difference between the reference to Shelnut et al. and the instant claim is that the reference does not explicitly teach activating the non-continuous metal layer.

Palmans et al. teach depositing an activation layer wherein the activating layer within the recess comprises of palladium (column 6 lines 58-67) is formed on the non-continuous metal layer and the at least one non-deposited region within the recess.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Shelnut et al. by activating the non-continuous metal layer as taught by Palmans et al., because it would form a catalytic surface in order for the seed layer to deposit on the barrier layer.

Relevant to claims 4-5, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Shelnut et al. by activating the non-continuous metal layer using palladium as taught by Palmans et al., because a skilled artisan would be able to select from among known suitable activating metals, and because it would form a catalytic surface in order for the seed layer to deposit on the barrier layer.

Regarding claim 2 and 10, Shelnut et al. teach forming a high aspect recess comprising an aspect ratio up to 15 (paragraph 32), which is within the range of the instant claim.

Regarding claim 3 and 11, Shelnut et al. teach forming a non-continuous comprising of TTiN (example 1).

Regarding claim 12, Shelnut et al. teach electrolessly depositing a copper layer comprising a grain size of about 1  $\mu\text{m}$  or greater, since the copper layer of Shelnut et al. is deposited by the same method and conditions as those of the instant claim.

Regarding claims 6, 13 and 15, Shelnut et al. teach electroplating a copper layer on the seed layer (paragraph 26).

Regarding claim 7, Shelnut et al. teach utilizing a chemical mechanical polishing process (paragraph 33).

Regarding claim 8 and 14, Shelnut et al. teach forming a substantially void free metal fill layer (paragraph 26).

### ***Response to Arguments***

Applicant's arguments have been fully considered but they are not persuasive.

In the arguments presented on page 2 of the amendment, the applicant argues that Palmans et al. do not disclose forming a non-continuous metal layer. The examiner agrees that Palmans et al. do not use the word "non-continuous" to describe the metal layer. However, since the metal layer (i.e., Ti barrier layer) of Palmans et al. is deposited by the same method (i.e., physical vapor deposition or atomic layer deposition, see column 7 lines 53-56) as that of the instant invention and to a thickness range of 15 nm, or 150 Angstrom, (column 8 lines 20-24), in features having the aspect ratios of 2:1 or higher (column 9 lines 5-10), it would have been obvious to one having ordinary skill in the art to expect that the Ti layer of Palmans et al. is non-continuous. Furthermore, since the palladium activator solution and subsequent electroless plating solution is applied on the surface of the metal layer, it would have been obvious to one having ordinary skill in the art to expect that the activator solution and electroless plating solution is activating or depositing on the metal layer and at least on the non-deposited region within the recess.



***Conclusion***


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LVV

August 24, 2006

  
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